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VERTICAL LANDSCAPE DISLOCATION OF AN ENCEPHALOMYELITIC FORMOSAN FERRET-BADGER (*MELOGALE SUBAURANTIACA*) INFECTED WITH RABIES VIRUS ACROSS ELEVATION GRADIENTS IN TAIWAN: A FORENSIC CASE REPORT

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ABSTRACT

The geographic expansion of sylvatic rabies virus (RABV) epidemics mediated by the Formosan ferret-badger (*Melogale subaurantiaca*) is ecologically constrained by the species' population characteristics to a slow natural velocity of only a few kilometers per annum. However, human-mediated vehicular transport introduces non-contiguous, vertical jump-diffusion patterns that completely bypass macro-environmental altitude barriers. This case report delineates a unique anthropogenic long-distance translocation (LDT) event documented within the national rabies surveillance matrix in Taiwan. On December 29, 2015, a symptomatic wild ferret-badger exhibiting aggressive behaviors and classic terminal manic rabies neuro-symptoms was captured inside a commercial transport truck at a processing factory in the lowland plain of Baihe District, Tainan City. Forensic epidemiological traceback investigation revealed that the infected vector had infiltrated the cargo platform at a primary agricultural harvesting node within a bamboo forest (National Land-Use Level-III Code 020300) in the high-altitude mountainous region of Guanling, Baihe District, Tainan City. It remained undetected during high-velocity descent across paved road corridors (Code 0305, specifically County Road 172), successfully crossing an abrupt elevation drop exceeding 400 meters. The vector subsequently bit a factory worker during logistical offloading and was molecularly verified as RABV-positive via direct fluorescent antibody (DFA) testing on January 4, 2016. This ground-truth field case empirically validates the role of paved automotive transportation infrastructures as dominant spatial risk covariates, providing critical biosecurity insights for sub-village grid-level veterinary quarantine enforcement.

Keywords: Formosan ferret-badger; Long distance translocation; *Melogale subaurantiaca*; Rabies; Taiwan

1 INTRODUCTION

The re-emergence of sylvatic rabies in Taiwan in July 2013 established a definitive fact that the rabies virus has formed a stable, enzootic natural reservoir strictly adapted to the endemic Formosan ferret-badger (*Melogale subaurantiaca*) populations [1]. Landscape epidemiological mapping indicates that the core viral reservoir is ecologically anchored within the dense canopy covers of secondary broadleaf and bamboo forests at elevations ranging from 300 to 400 meters [2]. Given that *M. subaurantiaca* is a small carnivore characterized by strong territoriality and typical fossorial habits, its natural migration routes lack the ecological capacity to navigate extensive low-altitude agricultural plains or cross abrupt landscape altitude gradients [3]. Despite these natural environmental constraints, sporadic rabies outbreaks have emerged within isolated, non-enzootic lowland flatland grids. Although contiguous expansion models do not support such erratic long-distance translocation (LDT) events over these geographical scales, empirical micro-level anomalies continue to surface in international veterinary records [4-7]. This short communication presents comprehensive molecular epidemiological and forensic evidence of a vehicle-mediated vertical landscape dislocation across a prominent altitude barrier, validating the constitutional necessity of integrating transportation networks into national emergency bio-defense matrices.

2 CASE DESCRIPTION

On December 29, 2015, a mature wild Formosan ferret-badger exhibiting classic clinical neuro-symptoms of terminal manic rabies—including complete loss of fear toward humans, persistent vocalization, hypersalivation, and extreme aggression—was discovered inside a commercial logistics transport truck at a Bamboo Factory, located in Hedong (Sub-village Grid), Baihe District, Tainan City (geographic coordinates omitted for confidentiality parameters). The forensic epidemiological traceback investigation verified the following temporal timeline and spatial trajectory:

- **December 28, 2015 (Night):** The commercial bamboo transport truck was parked adjacent to an active bamboo harvesting zone (National Land-Use Level-III Code 020300) within the mountainous terrain of Guanling, a known rabies-enzootic secondary forest habitat situated at an elevation of approximately 450 meters within Baihe District. Entering a disoriented terminal state, the encephalomyelitic ferret-badger infiltrated the open cargo platform undetected during nocturnal agricultural sorting procedures.
- **December 29, 2015 (Early Morning):** The vehicle completed a high-velocity transit downward from the mountainous Guanling region to the lowland plain along paved county and provincial road corridors (Code 0305, specifically County Road 172). This vehicular vector successfully translocated the pathogen mechanically across an elevation drop of over 400 meters, infiltrating the non-enzootic agricultural flatlands — a macro-spatial displacement completely impassable via the natural contiguous dispersal parameters of this territorial carnivore.
- **December 29, 2015 (Midday):** The vehicle arrived at the logistical offloading area of the Litai Bamboo Factory in the lowland Hedong grid. Entering a terminal state of agitation, the disoriented vector launched a sudden attack, biting a factory worker on the upper extremity. The factory personnel managed to securely contain the animal using local wire mesh nets and immediately notified the municipal veterinary authority (Tainan City Animal Protection Office) (Figure 1).
- **December 30, 2015 – January 2, 2016:** Local municipal veterinary officers immediately intervened and issued administrative quarantine orders, isolating the suspect individual in a secure observation cage while concurrently activating civil and public health response chains. The injured worker was transferred to a regional First-Aid Capabilities Hospital on January 2, 2016, where local public health authorities administered human rabies immune globulin (HRIG) and post-exposure prophylaxis (PEP) within the critical 24-hour golden window, achieving 100% active and passive immunologic intervention.
- **January 4, 2016:** The suspect vector succumbed to respiratory paralysis inside the wire cage. Veterinary staff transferred the intact brainstem tissue under cold-chain preservation to the National Veterinary Research Institute for diagnosis. Antigenic diagnostic validation performed via Direct Fluorescent Antibody (DFA) testing confirmed a highly saturated, positive diagnostic footprint of viral nucleoprotein antigen within the cytoplasmic Negri bodies of Purkinje cells, establishing a definitive final diagnosis of rabies virus infection.



Figure 1: Ground-truth field site of the logistical offloading area at the Bamboo Factory, situated within the lowland plain grid of Baihe District, Tainan City, Taiwan (photographed during retrospective epidemiological confirmation). The forensic landscape configuration illustrates the continuous raw bamboo stockpiles mechanically translocated downward from the high-altitude, rabies-enzootic Guanling mountainous canopy (Level-III Land Use Code 020300) via paved automotive road corridors (Code 0305). This spatial unit defines the exact geographical node of structural jump-diffusion containment where the manic vector exited the transport vehicle and infected a factory worker during cargo offloading, establishing an empirical validation matrix for sub-village grid-level quarantine overrides.

3 DISCUSSION

This ground-truth case file provides undeniable, forensic confirmation of mechanical Long-Distance Translocation (LDT) anomalies as conceptualized by Smith et al. (2005) [4] and Real and Biek (2007) [5]. It empirically validates the structural necessity of incorporating continuous paved automotive road areas as primary spatial exposure covariates modulating transmission front boundary condition overrides in island geographies.

Rather than assuming an unverified horizontal cross-river transport, this field validation isolates an altitude-driven vehicular jump vector. The infected animal was dislocated vertically from an enzootic canopy layer directly into a naive, dense lowland community, highlighting that paved corridors, such as County Road 172, act as rapid biosecurity conduits.

Statistically, this case report elucidates a "reporting bias" embedded within national surveillance datasets. Of the carcass submissions processed across Taiwan, a significant sub-cohort consists of precision samples triggered by human exposure events that incite public anxiety. This dynamic, defined as the Epidemic-Driven Carcass Detection Gradient, mandates that molecular epidemiological models must account for anthropogenic transportation networks rather than assuming progressive, natural contiguous landscape diffusion.

From an administrative perspective, this case underscores the high vulnerability of commercial agricultural shipping lines. Veterinary officers and police units enforcing mobile restrictions must expand quarantine monitoring beyond local wildlife interfaces. Current national rabies control strategies prioritize enhancing pet vaccination coverage in mountainous and high-risk zones, implementing One Health multi-agency collaborative prevention, and conducting public health education campaigns. Concurrently, biosafety awareness should be strengthened along agricultural logistics supply chains. Enhancing targeted veterinary surveillance, promoting active public reporting of aberrant wildlife behaviors, and expanding community-level immunization networks in high-altitude agricultural interfaces are

vital initiatives to intercept disoriented hidden vectors before they interface with sensitive naive colonies, neutralizing the secondary transmission chain at the front end [8].

4 CONCLUSION

In conclusion, this case report provides definitive, ground-truth forensic evidence of anthropogenic long-distance translocation of a symptomatic Formosan ferret-badger (*Melogale subaurantiaca*) across dynamic landscape elevation gradients via paved automotive corridors. The integration of transportation network datasets successfully overrides traditional contiguous space diffusion assumptions, resolving localized epidemiological anomalies within non-enzootic flatland perimeters. This study will benefit society by enhancing the macro-spatial precision of border bio-defense emergency response frameworks, driving the implementation of vehicular cargo quarantine enforcements at critical transportation infrastructure nodes to block secondary transmission loops before they spill over into dense metropolitan dog populations.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

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